

THE TECHNICAL NEWS BULLETIN OF THE NATIONAL BUREAU OF STANDARDS July 1974

DIMENSIONS

NBS



Waste Not, Want Not

DIMENSIONS

NBS

JULY 1974 / Vol. 58, No. 7 / ISSUED MONTHLY

CONTENTS

- 147 Privacy and Security: Twin Challenges to Computer Technology
- 150 Edward Uhler Condon
- 152 Sounds That Hurt
- 154 Noise Pollution Grows
- 156 Waste Not, Want Not
- 159 NBS Programs Promote Materials Durability
- 160 Highlights
- 161 NBS Urges Charcoal Grill Safety
- 161 Bus Experiment Aids Commuter, Energy Conservation, Environment
- 162 New Voltage Transfer Technique
- 163 Stray Energy Monitored
- 164 New Computer Standards Proposed
- 164 JILA Fellows Named
- 165 Jerry-Can Standard Approved
- 165 Two Standards Under Review
- 167 Publications

Nat. Bur. Stand. (U.S.) *DIMENSIONS/NBS*
CODEN:DNBSBG 58(7) 145-168

Superintendent of Documents Catalog No. C13.13:58/7

Library of Congress Catalog No. 25-26527



COVER: Every American annually uses 18,000 kilograms of new materials. Yet we live in a materials-limited society in which unchecked consumption may lead to serious economic and social consequences. Recent efforts of NBS to focus on materials conservation and utilization are described on page 156.



U.S. DEPARTMENT OF COMMERCE
Frederick B. Dent, Secretary

Betsy Ancker-Johnson
Assistant Secretary
for Science and Technology
NATIONAL BUREAU OF STANDARDS
Richard W. Roberts, Director

Prepared by the NBS Office of
Information Activities
Washington, D.C. 20234
William E. Small, Chief
Richard S. Franzen,
Chief, Editorial Section
Sharon A. Washburn,
Managing Editor

Contributing Editors
L. Kenneth Armstrong, Robert J.
Griffin, Jr., Kent T. Higgins, Madeleine
Jacobs, Juli Kelley, Stanley
Lichtenstein, Frederick P. McGehan,
R. David Orr, Alvin L. Rasmussen,
Arthur Schach, Collier N. Smith

Visual Editor
Charles Messina, Jr.



The National Bureau of Standards serves as a focal point in the Federal Government for assuring maximum application of the physical and engineering sciences to the advancement of technology in industry and commerce. For this purpose, the Bureau is organized as follows:

The Institute for Basic Standards
The Institute for Materials Research
The Institute for Applied Technology
The Institute for Computer Sciences and Technology
Center for Radiation Research
Center for Building Technology
Center for Consumer Product Safety

Formerly the **TECHNICAL NEWS BULLETIN** of the National Bureau of Standards.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Annual subscription: Domestic, \$6.50, foreign, \$8.25, single copy, 65 cents. The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 30, 1976.

A NOW CLASSIC and very imaginative example of computer crime carried out by a young electrical engineer on the West Coast. Posing as a customer, he discovered a way to "sign on" the computerized central supply division at the Pacific Telephone and Telegraph Co. Before someone betrayed him, he had illegally ordered and had delivered over \$1 million worth of equipment without paying for it.

Privacy & Security: Twin Challenges to Computer Technology

MENTION the sophistication of computers and computer systems and their vast use these days and you're likely to open a Pandora's box. Out flies technology as a blessing—and a curse. Easily accessible information can facilitate business transactions and assist communications. It can serve a critical need by rapidly providing medical data. But on the negative side, the deep-rooted and irrational dread of mechanical "brain power" fuses with the real threat of unrestrained information gathering and dissemination.

Dr. Ruth Davis, head of the National Bureau of Standard's Institute

for Computer Sciences and Technology (ICST), states the situation like this: "There is a societal problem today that signals a major confrontation between the individual in modern society and modern technology. It is the problem variously referred to as that of 'Invasion of Individual Privacy,' 'Data Security,' or 'Computer Crime.'"

She sees several possible results from the impending conflict: It could "... trigger off negative chain reactions as well as possibly damaging restrictive controls on many applications of technology." Or, if the variation page

PRIVACY *continued*

ous branches of Government and industry treat the problem lightly, "... then computer and communications technology could indeed victimize individuals and intrude upon their rights as citizens and consumers."

Instant Info

The hum and stutter of nearly 144,000 computers in the United States alone signal isolated pockets of data or whole networks of information systems capable of instantly relaying data coast to coast. Who controls the data gathering, who decides it's valid, who has access to it, how do we know it can't be tampered with?

The right of privacy is a legal matter. That right is not spelled out in the Constitution, although privacy cases have been prosecuted under other rights. But states like California have already begun to act in favor of the individual by passing laws on privacy.

On a national level, the President's Committee on the Right of Privacy, chaired by Vice President Gerald Ford, is surveying the situation and will come up with recommendations.

Davis heads one of the Committee's 10 task forces; Robert Blanc, an ICST computer specialist, serves on another.

In addition, NBS has sponsored two conferences on privacy and computer security—one in November, 1973, and one in March 1974. These meetings brought together parties involved in the various aspects of the privacy/security question, including the legal and the technological. The purpose was to get an overview of the entire spectrum of activities and to foster coordination at all levels.

Representatives from Government,

the computer industries, consumer groups and academia attended and participated. Congressmen Barry Goldwater, Jr., (Calif.) and Edward I. Koch (N.Y.), both sponsoring separate legislation on privacy, presented their views at the March conference. Since that time, they have cosponsored a bill that would define information practices to be followed with respect to personal data files maintained by Federal agencies.

Whether or not the rights are defined and listed, at least one facet of the technological problem must be confronted: computer security. Finding ways of protecting computers from physical damage or manipulation and of protecting data and the access to it require the aid of science and technology.

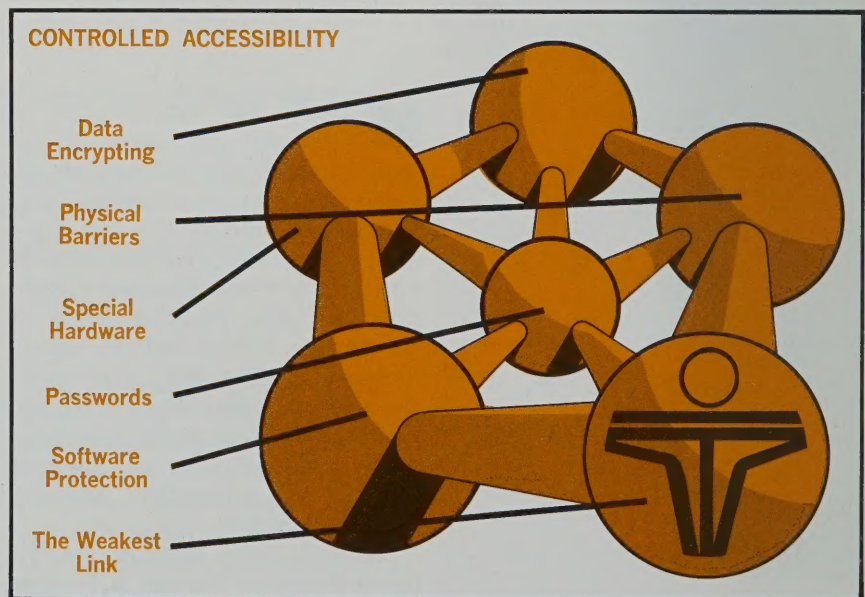
Secure?

At present, how secure are computer systems? Clark Renninger, ICST's staff assistant for computer

utilization programs, feels that a poll of experts would probably produce the consensus that, "No system on the market today is a secure system." Why? Because security has never before been a design priority.

That picture will probably be changing soon. One main mission of ICST is to provide automated data processing standards for use by the Federal Government. With its more than 7,000 computers, the U.S. Government is the largest single computer user in the world. With Federal emphasis on privacy and security and with NBS coordinating with industry and consumers in developing secure systems and security standards, the results of their efforts will extend into both the public and private sectors.

A main drawback to the easy assimilation of security technology is a perennial hang-up—money! It's going to cost plenty. As an example, Davis has used a model of a hypothetical credit reporting agency. This



A weak spot in bank computing systems was found by a clerk in a Washington, D.C., bank. Noting that the bank's computer checked only the magnetically coded deposit numbers on the bottoms of incoming deposit slips, he replaced the usual supply of deposit slips on lobby desks with slips coded with his own account number. Depositors using forms from the lobby desks unknowingly added their money to his account. A few days later he made a large withdrawal and disappeared for good.

agency, beginning with 1 million records containing 220 characters of data each, would have an average file growth of 10 percent per year—33 million additional characters annually. That's just to meet the requirements of pending security legislation, and it discounts growth of the agency. In 7 years the size of the file would double, software checking procedures would require implementation and processing time for each query would increase. Larger files would also mean more hardware. The cost rise would be significant.

Critics of computer security say that security at a high price is not necessary. They admit that at present the potential for unauthorized persons to gain access to files or to alter data is vast. But they cite statistics like those of a Stanford Research Institute study showing that documented transgressions are few.

On the other hand, computer crime is difficult to discover, and it's more difficult still to find the offender. Davis feels that costs could be spread among supplier industries, service industries, the consumer public and Government, thus easing the burden through sharing.

Davis also states, "Paying for privacy and security is not new to the American public. Some 15 percent of the 100 million telephones in the United States have unlisted phone numbers. The American public is currently paying \$150 million for this right." She cites other examples: security apartments, private physicians, private housing.

Finding Security

If indeed we want security, we can't come by it simply, regardless of

cost. Davis summarizes the problem:

Threats to information systems range over a broad spectrum including events such as: natural catastrophe, sabotage, theft, bugging, accidental disclosure and physical assault. The countermeasure spectrum is just as extensive, for example: physical barriers and guards, passwords and identification badges, data encryption, audit trails, personnel practices, backup copies of data and access control software. Not all threats will exist for each system, and not all countermeasures are appropriate to counter each threat. Each information system must be analyzed to design an adequate security environment.

It is only when armed with these types of data and knowledge that an appropriate approach to the problems of data confidentiality and security can be formulated.

NBS is already taking action to make computer security a reality. By the fall of 1974, ICST intends to provide a set of guidelines for achieving physical security within Federal automated information systems. This should provide safeguards for computer equipment. NBS is also completing an initial survey of Federal practices in providing for computer security which will be published this year.

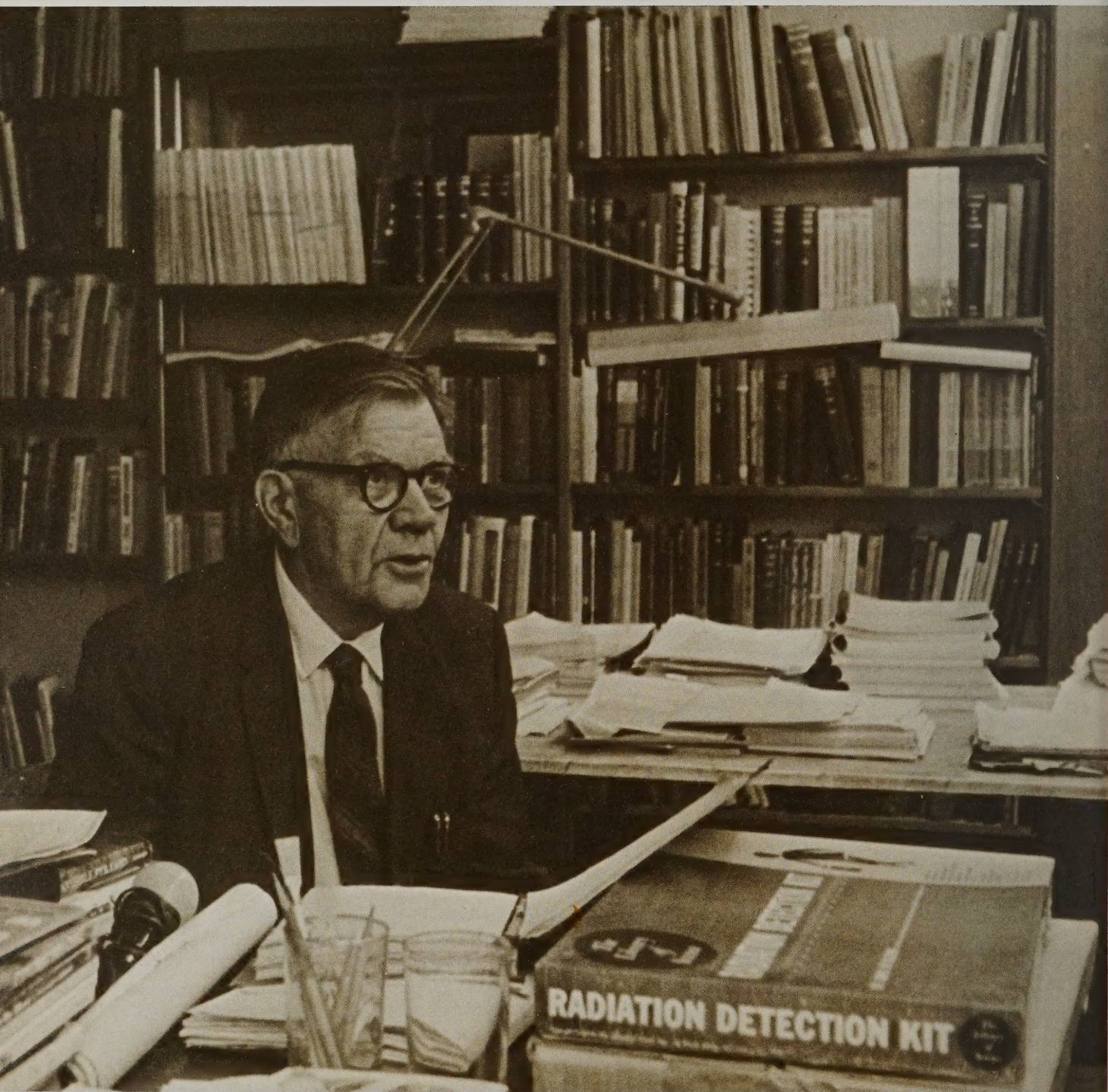
Safeguarding the system and the information itself is much more difficult. Supporting science and technology is not yet adequately developed for this purpose. But R&D is in motion both in Government and the private sector. NBS is attempting to determine whether operating system

software can control access to data. Ways of foiling the biggest threat to computer security—human ingenuity—are being examined. Unique identification methods like voiceprints, memory passwords and fingerprints can reduce the number of people who can gain access. And such methods can better pin down the identity of those who have access to computer information so that the computer criminal cannot easily shield himself in anonymity.

Other problems persist. For example, one person may have a right to certain information stored in a computer, but not to all. It is necessary to restrict, as well as to prevent, access.

Data encryption can provide a safeguard in cases where unauthorized access does succeed. By translating information into mathematical systems (algorithms), decoding becomes difficult. ICST has wrestled with the challenge of developing these algorithms to the point that they provide a maximum level of security. NBS is in the process of making these simple algorithms generally available. Making the algorithms available, by the way, does not give away a secret. The system can be used to make unique codes.

Even with the efforts underway in Government and industry, Davis sees that, "The privacy problem has already introduced serious stresses between society and technology." She feels that perhaps the only first step in solving the problem lies in the acceptance of responsibility by Government, the service industries and the courts. She says, "That first step is what we are striving for today." □



Edward Uhler Condon

Churchill Eisenhart*

DR. Edward Uhler Condon, fourth Director of the National Bureau of Standards and one of the foremost American physicists of the 20th century, died Tuesday, March 26, 1974, in Boulder, Colo. He was 72.

Condon was a brilliant scientist, with highly original ideas, a wide range of interests and a restless probing mind containing voluminous information indexed for instant retrieval. He could meet with scientists of diverse specialities and stimulate each with fresh enthusiasms and new insights. Whatever he knew, he saw with crystal clarity: he could summarize it in a nutshell on a moment's notice or discuss it in detail at length with experts, with equal ease.

He had an ever ready and exuberant sense of humor, a gift of repartee, but he could be wittily caustic when provoked. He was a cordial, genial, straight-forward individual who was fond of people, mathematics, science, chamber music and conversation but allergic to formality, fuzzy-mindedness, pomposity and all forms of physical exercise. He was an active Quaker, a firm believer in human dignity, an outspoken liberal and an anti-isolationist, who fervently hoped that international understanding and world peace could be furthered by continuance of World War II alliances. He gave freely of his counsel and his time; generously of his finances and his home.

Appointed NBS Director

Condon was the first Director of the National Bureau of Standards to be appointed from outside the Bureau's ranks, the first Director to be recruited from industry, the first theo-

retical physicist to head NBS and the first and only Director to reside in a house on the Bureau grounds.

He was appointed to this post by President Harry S. Truman on November 7, 1945, at the recommendation of Secretary of Commerce Henry A. Wallace. But before he could learn the ropes in his new job and take the reins firmly in hand, he was asked by Senator Brien McMahon of Connecticut to serve as scientific adviser to the Special Senate Committee on Atomic Energy, of which McMahon was chairman. As a result, for the remainder of 1945 and the better part of 1946, Condon held two positions: Director of the NBS and adviser to McMahon.

For several months "Professor" Condon "lectured" patiently to that exceptionally conscientious group of lawmaker "students," explaining in lucid layman's language the awesome propensities and potentialities of the split atom. The hearings on McMahon's bill to establish an Atomic Energy Commission ran from November 1945 to April 1946. It passed the Senate early that summer; was sponsored in the House by Representative Helen Gahagan Douglas of California; and the McMahon-Douglas bill, which became law on August 1, 1946, established the Atomic Energy Commission with complete civilian control over all aspects of atomic energy, peaceful and military, in the United States.

Revives and Reorganizes NBS

Condon was no stranger to the NBS when he became its Director. He was well acquainted with the Bureau's Washington campus, with some of its work and with many of its staff. He recognized the Bureau to be "one of the finest scientific laboratories in the country," with great potential for development in the postwar world. The

National Bureau of Standards was for him a scientific Mecca. To become its Director he was willing to accept a salary one-third less than he had been receiving as Associate Director of Research at the Westinghouse Laboratories in East Pittsburgh. He fully expected to stay at the Bureau for much of the remainder of his life, devoting his energy and skill to making NBS one of the greatest scientific laboratories in the world.

As soon as he became free to devote full time to NBS, Condon set about with vigor and determination to instill new life in many of the Bureau's traditional programs, to advance pure science at the Bureau and to move the Bureau forward rapidly to meet the greatly expanded needs of postwar science and technology. He was as much interested in effective administration as in quality research. He streamlined the Bureau's organization and rid the Director's Office of much routine.

A major reorganization of the Bureau's scientific and technical activities was put into effect on July 1, 1947. New programs in atomic physics, applied mathematics and building technology were launched. A new Office of Scientific Publications, established to oversee dissemination of Bureau scientific and technical information, and an Office of International Relations were instituted. In many areas, continuity of scientific administration was maintained by appointing promising Bureau scientists to upper echelon positions; young mathematicians, scientists and engineers were energetically recruited to head and staff new programs. Condon himself visited laboratory after laboratory to see what was going on—sparking new ideas and enthusiasm at every stop.

continued on page 166

*Dr. Eisenhart is a Senior Research Fellow at NBS.

1902-1974



Sounds That Hurt

DEAF people are not bothered by noise, which is a bit like saying that the goldfish swallowed by Cleo an hour ago is not bothered by cats.

Fortunately, noise is only very rarely as destructive of hearing as cats are of goldfish. Serious enough, however, and much more common, is the impairment of hearing by extended exposure to noise.

For example, the reverberating noise experienced by boilermakers and structural riveters produces a syndrome that the workers themselves long ago called "boilermaker's deafness." It is also by now well known that this hearing loss is the result of damage to the nerve conduction mechanism of the inner ear and that the loss is greater for high tones.

Even when it does not diminish our ability to hear, noise bothers us in other ways. It can give us headaches, it can distract us when we are trying to concentrate or it can be just plain irritating. Potentially most harmful of all, it can prevent us from hearing other, more important sounds, such as a warning of imminent danger.

Action Now

The noise problem is not new of course. But in recent years, the tempo of industry has accelerated. The num-

ber of noise-producing appliances in the home has increased. More and larger jets are taking off and landing. Trucks and cars rumble along the highway in ever-growing numbers. In short, the noises in our environment—and the complaints against them—have been rising in a steady crescendo.

In response to the escalating noise levels and demands for action to control them, a beginning, at least, has been made in the wide-ranging effort that will be needed. The Bureau of Motor Carrier Safety, the Environmental Protection Agency, the Consumer Product Safety Commission, the Justice Department, the Veterans Administration and other Government agencies concerned with aspects of environmental quality have turned their attention to the matter and, with their support, a number of projects relating to noise have been carried out or are now in progress at the National Bureau of Standards.

In this work, NBS is employing its acoustical laboratory facilities and its long experience in developing and working with standards and measurement techniques for sound, viewed both as physical energy and as human sensation. The NBS projects described here deal with three main topics: (1) characteristics of particular

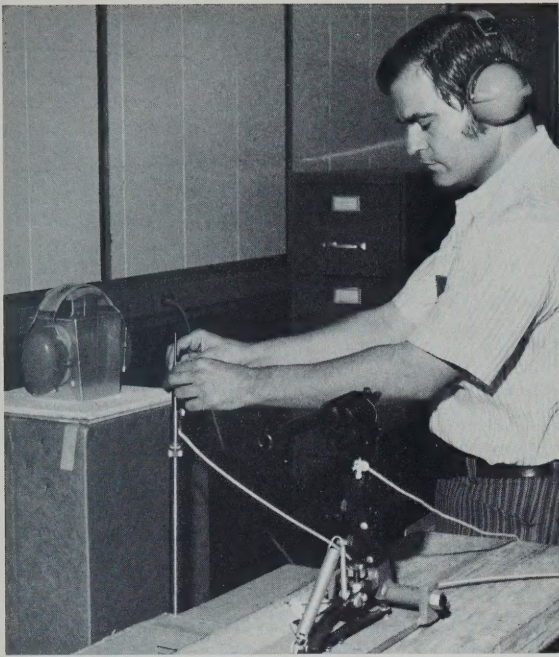
noise sources (vehicles, toys), (2) noise monitoring equipment and noise-level regulations and (3) methods of measuring hearing impairment and the performance of hearing protectors and hearing aids.

Another set of NBS projects, in the area of psychoacoustics, aims to bring about more consistent and reliable determinations of the aversiveness (unpleasantness) of noises. These are described by Dr. John Molino of the NBS Sound Section elsewhere in this issue.

Noisy Toys

A child would probably have a low opinion of a toy gun that made a puny pop. On the other hand, the Consumer Product Safety Commission (CPSC) is concerned by toy guns and rifles, and other toys, that produce noises that may alter, at least temporarily, a child's hearing or that may interfere with his ability to communicate verbally. A project to study such toys was therefore set up in the NBS Applied Acoustics Section.

One development of the project is a device for measuring the noise produced by exploding caps such as are used in toy pistols. The device will provide a uniform and reliable basis for determining the conformity of



Left: Michael Kobal works on developing a test for hearing protectors used on firing ranges. Top: Jonathan Adler measures the sound level of a lawnmower. Sound of mower is picked up by the microphone just below his right ear.

such caps with noise level specifications which the CPSC may establish. Also being studied are the warning signals (sirens and whistles) on children's bicycles, which can interfere with the child's ability to receive auditory signals. With his siren sounding, a child riding in the path of a car may not be able to hear its horn.

Loud Vehicles

The Bureau of Motor Carrier Safety (BMCS) of the Department of Transportation, acting on evidence that the hearing of commercial vehicle drivers could be damaged by vehicle-generated noise, decided to draw up some rules with the specific purpose of reducing this risk. It found, however, that little information was available on the noise levels actually encountered in trucks. At this point, NBS was asked to conduct a measurement program. Data were taken on the in-cab noise environment of 15 representative over-the-road trucks under various operational conditions. Not only do the data support the need for BMCS rules, but they will also be useful to states and municipalities for establishing their own standards and regulations.

Again, there is not only the risk of damage to the hearing of the com-

mercial vehicle driver, but there is the further hazard that the vehicle noise may prevent him from hearing warning signals—from an oncoming ambulance, for example. This problem, including the case of private automobiles driven with the windows closed, is studied in another project.

Lawnmowers

In a different area, an evaluation of the hearing-damage potential of lawnmowers is currently being made by NBS for the CPSC. Utilizing information on typical use and exposure patterns, a test method for measuring lawnmower noise at the operator's ear will first be worked out. From the data obtained with the test method a maximum noise level will be established that should prevent long or short term hearing loss from lawnmower use. Also, to permit the operator to give and receive auditory communication, a safe communication zone around the device will be defined.

Noise Regulations

On the authority of the Occupational Safety and Health Act of 1970, regulations have been promulgated that set limits on occupational noise levels in industry. The regulations, in

turn, have led to a proliferation of devices, called noise exposure meters, that give a single number measure of a person's noise exposure during a work day. Since the reliability of these commercial devices was not known, the Environmental Protection Agency supported a program in the NBS Applied Acoustics Section to evaluate a number of them, a task which has been completed. The program also calls for development of a noise exposure meter that will give hourly readings of a person's noise exposure over a full 24-hour period. An important use of this will be in studies to ascertain whether a person's hearing has a chance to recover after working in a noisy environment for an 8-hour day. At present no such device is on the market.

One of the problems in administering noise regulations is that the existing regulations are not consistent with one another. The Sound Section therefore undertook to survey and catalog, by product class, the various Federal noise regulations now on the books or in preparation. From a study and intercomparison of these regulations, recommendations will be made on ways to coordinate the rules of different agencies. The result should

continued on page 166

Noise Pollution Grows

When do we start to avoid it?

John A. Molino*

POLLUTION is the release of harmful and unwanted quantities into the environment. In order to combat pollution successfully, the measurement of these quantities plays an essential role. But first, it is necessary

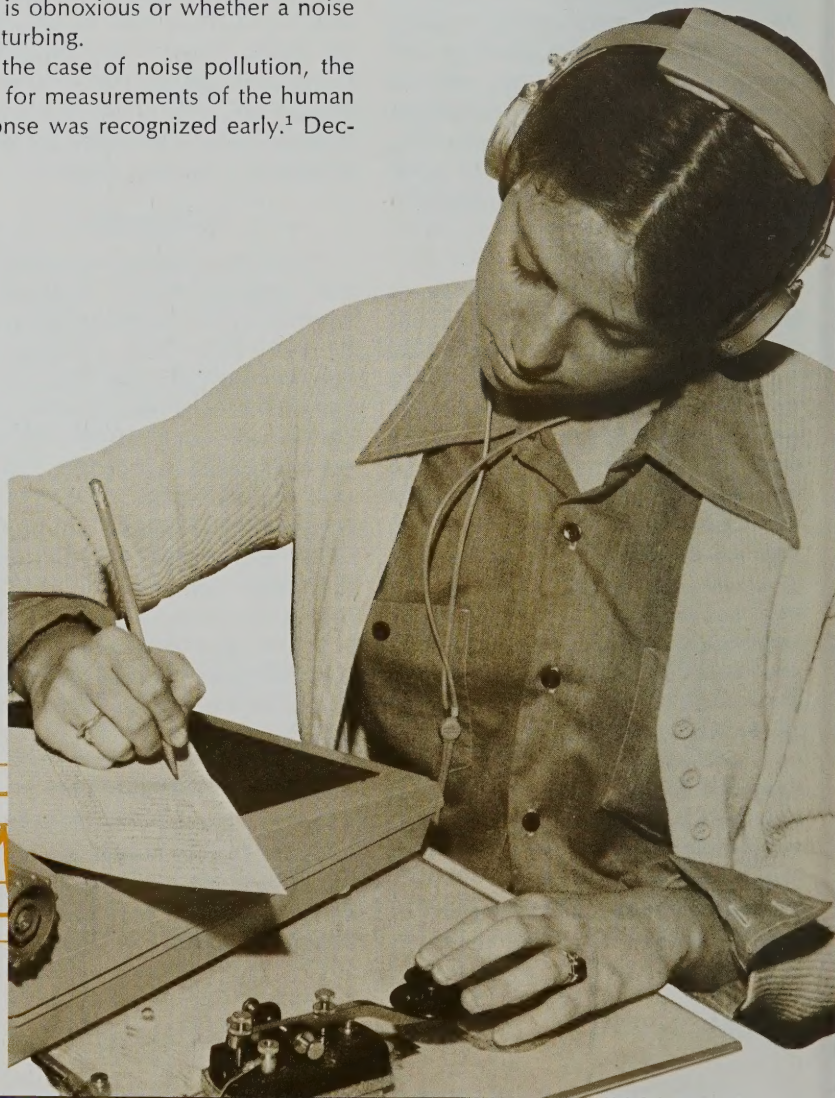
*Dr. Molino is a research psychologist in the NBS Sound Section.

to define what is harmful and what is unwanted. These definitions ultimately come from people, not machines. For certain types of pollution measurements the human response must be incorporated in the measurement procedure. No matter how automated the device, no measuring instrument can by itself tell whether an odor is obnoxious or whether a noise is disturbing.

In the case of noise pollution, the need for measurements of the human response was recognized early.¹ Dec-

ades of research led to several national and international standards for predicting the loudness and noisiness of sounds. Unfortunately, these psychophysical standards are in conflict. Furthermore, it is not clear which, if any, of them defines "unwantedness" or aversion. Different segments of society and different sectors of the economy choose among these various measurement procedures and, as a result, arrive at different answers. This situation hinders the design and marketing of quieter products, impedes

Student studies Russian while being subjected to varying amounts of sound. She indicates with the response key when the sound becomes aversive.



rational urban planning and could expose the society to unnecessary noise hazards.

The source of some of these discrepancies resides in the variety of psychophysical experiments on which the standards are based. An important procedural difference among these experiments is the use of different verbal descriptions in the evaluation of the sounds. Some experiments require subjects to rate various sounds according to their "loudness," others according to their "annoyance" and still others according to their "noisiness" or "unpleasantness." If one pursued this course further, the number of possible standards would be limited only by the number of words which can be used to describe sounds.

The Sound Section at the National Bureau of Standards has a small team of research psychologists who are taking a somewhat different approach. These researchers, Gerald Zerdy, Onslow Wakeford and myself, are developing measurement techniques which will hopefully resolve some of these discrepancies. The hallmark of our experiments is that the human response is measured without using any verbal descriptions of the sounds. We have posed a very simple question: At what intensity level will people begin to escape or avoid a given sound? The subjects in our experiments are not asked to respond when the sound is "loud," "noisy," "annoying" or "unpleasant." They are often engaged in another task, for

example, learning to read and write Russian, while the sounds are introduced. They have a response key which can control the sound. If the subjects work on the response key in order to escape or avoid the sound, this activity implies that the sound must be in some way unwanted or aversive. Furthermore, we hope that different response procedures, unlike different verbal descriptions, will yield the same psychophysical scale.

What has the psychoacoustics program at NBS demonstrated so far? First, we have shown that psychophysical measurement techniques without verbal descriptions are feasible for collecting data on human reactions to sound. Second, in preliminary experiments, we have determined the function relating human aversion and the frequency or pitch of the sound.² The aversion function differs considerably from many of the standard functions and to a certain extent from the widely used A-weighting function. We have also shown that these measurements can be useful in answering practical problems. The techniques developed at NBS have helped the U.S. Coast Guard to make certain design decisions in engineering an easily detected yet more pleasant sounding foghorn.³

What experiments are being planned by the psychoacoustics program for the future? These new techniques will be verified in a number of parallel experiments using different

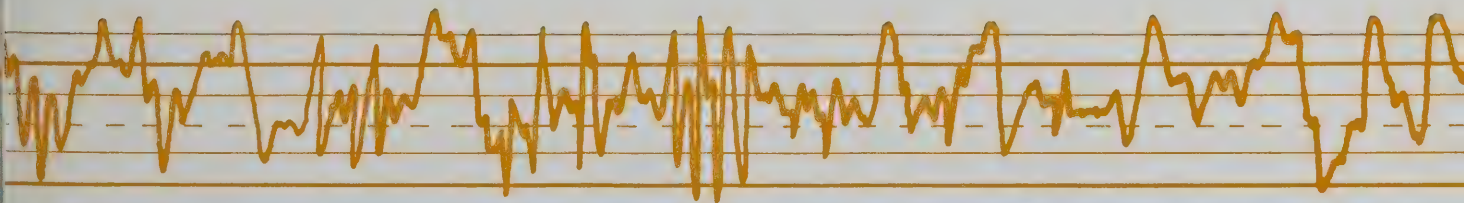
escape and avoidance tasks. We will study human aversion for different temporal patterns of sound. Hopefully, we will be able to improve the correction for intermittent sounds used by the Environmental Protection Agency and other groups.

Studies of product noise from power tools and lawn care equipment are proposed, including prediction for the Consumer Product Safety Commission of possible hearing damage resulting from the use of such products. These investigations will be of interest to acousticians, engineers, lawyers and urban planners concerned with arresting the growth of noise pollution and eventually reversing that process. Such specialists are putting science, technology and social services to work to stop noise pollution. They need reliable and accurate measurements that will somehow reflect the human response to noise.

By establishing levels of noise that are aversive, and those physical characteristics of the noise that make it so, we are contributing technical information, which we hope will result in a quieter place for us all to live. □

References:

1. Fletcher, H. and Munson, W. A., Loudness, its Definition, Measurement, and Calculation, *J. Acoust. Soc. Amer.* 5, 82-108, 1933.
2. Molino, J. A., Equal Aversion Levels for Pure Tones and 1/3-Octave Bands of Noise, *J. Acoust. Soc. Amer.* (in press).
3. Molino, J. A. and Zerdy, G. A., Psychophysical Evaluation of Acoustic Navigation Aids NBS Report 10960, Washington, D.C. (1972).



THE recent energy crisis brought home to the American people a strongly worded message: Conserve or suffer serious economic and social consequences.

Translated, this message means that we live in a world of limited natural resources. It is becoming increasingly evident that a national materials conservation program would be an important part of an overall strategy aimed at maintaining or improving our standard of living.

Unfortunately, few people realize resources mean not only fuels but rather all materials. The raw materials for almost all substances in our everyday surroundings exist in finite quantities in the world.

Within this materials-limited framework, the United States alone uses 1.8 billion kilograms (4 billion pounds) of new materials each year. To put it on a more personal basis, about 18,-

000 kilograms (40,000 pounds) of new materials were used in a recent year for every American man, woman and child. That includes 4100 kilograms (9,000 pounds) of sand and gravel, 4300 kilograms (9,500 pounds) of stone, 390 kilograms (850 pounds) of

cement, 590 kilograms (1,300 pounds) of iron and steel, 27 kilograms (60 pounds) of aluminum and 6.8 kilograms (15 pounds) of lead.

The United States is already confronted with some shortages of materials, although they rarely make the front page in daily newspapers as the long lines at gasoline stations did. For instance, the United States now imports all its platinum, mica, chromium, strontium, cobalt, tantalum, and columbium from foreign countries and it is possible that other critical shortages may arise unless existing materials are more efficiently utilized.

Disposable Society

To focus on the problem of materials shortages, conservation and utilization, the National Bureau of Standards recently hosted two national meetings—one on materials

turn page



Waste Not

Want Not

Materials Conservation: An Old Adage Revisited



Photo courtesy National Center for Resource Recovery, Inc.

WASTE *continued*

conservation and the other on mechanical failures, which represent a major source of materials waste as well as a safety problem. Together, the conferences attracted nearly 500 prominent spokesmen from Federal, State and local governments, industry and universities who considered the technical, economic, political and legal problems involved in mechanical failures and in increasing conservation by more efficient recovery and recycling of used materials.

The National Materials Conservation Symposium was concerned with

resource recovery and utilization—recovering and recycling materials—principally from municipal solid waste. The conference was cosponsored by NBS, the U.S. Bureau of Mines, the Environmental Protection Agency, the National Center for Resource Recovery, Inc. and the American Society for Testing and Materials.

In opening the conference NBS Director Richard W. Roberts noted "We've been abusing two of our greatest assets: natural resources and technology . . . we've let ourselves develop a new ethic to replace the stitch-in-time-saves-nine approach. Now we don't bother with repairs, we

throw it away and get a new one. To make things worse, we've aimed our technology at making this condition possible."

Roberts said that technology must be developed toward materials recovery, finding substitutes for scarce commodities and making materials more durable.

One Man's Trash

Keynote speaker Elliott M. Estes, executive vice president of General Motors Corp., pointed out that Americans discard some 326 million metric tons (360 million tons) of residential, industrial and commercial waste each



Photos courtesy National Center for Resource Recovery, Inc.

year. Yet one man's trash can be another man's treasure. According to Estes, 15 to 18 percent of what we now throw away is recoverable and reusable.

Estes noted that "80 to 85 percent of all automobiles that are removed from the roads each year are recycled without any problem because their last owners directed them into the existing scrap recovery network Even so, some 400,000 cars are abandoned outside the recovery system each year, and it's estimated that about 15 million derelict auto hulks are now rusting away across the

country outside the recovery network." These hulks represent a major aesthetic and environmental problem, he said, as well as a serious waste of resources.

He urged states to remove costly, time-consuming procedures that are now roadblocks to clearing titles of obviously abandoned autos so they can be recycled and reused.

Agenda for Action

Roadblocks to recycling, such as the ones described by Estes, were the topics for discussion in workshops at the Materials Conference. Participants developed position papers identifying important problems in and obstacles to accomplishing adequate recovery and reuse of ferrous metals, nonferrous metals, textiles, plastics, rubber, glass and paper.

These position papers are intended to provide "an agenda for action and guidelines for policy makers in the private sector and government," according to Dr. Emanuel Horowitz, a conference organizer and deputy director of the NBS Institute for Materials Research.

Horowitz noted that it is "necessary to continue the dialogue on the general topic of materials conservation and utilization so that attention is not diverted from this important issue." As a result, future conferences are planned which will examine topics such as substitute materials, reliability, durability and materials data and information.

National Policy Needed

Speaking at the Mechanical Failures Conference a week after the Materials Conservation Conference, Roberts emphasized the need for a coherent national policy on materials. He told attendees, "If you look hard enough, you'll find there is a national policy on materials and mechanical failures, but it is a diffuse, uncoordinated, stop-gap policy that lacks a real focus."

"Public safety, new materials, productivity, materials shortages, pollution are all a part of a problem that

affects all Americans. You and I, both as concerned citizens and technical specialists, can and should contribute to the creation of such policies. This

is a large assignment, but a necessary one if we are to make the best use of our national resources—materials, energy, technology and people." □

NBS Programs Promote Materials Durability

For nearly as long as it has existed, the National Bureau of Standards has been involved in promoting the improved use of materials by increasing their reliability and enhancing their durability in service. Currently, NBS has strong research programs in a number of areas such as the following:

- **Nondestructive evaluation (NDE).** Using NDE techniques, scientists can analyze a material for defects and reliability without destroying its structure. These techniques are used for quality control during manufacture and for maintenance inspection during the life of a structure. As such, NDE techniques contribute to materials conservation and utilization through more efficient design, use of substitute materials, improved quality control, more economic parts fabrication and increased service life.

- **Failure Analysis.** For many years the Bureau has had a material, product and structural failure analysis program aimed at reducing loss of life and property. Serving mainly as a support to other government agencies, scientists in this program investigate the failure or unsatisfactory performance of materials, products or structures to determine the cause of a failure and recommend ways of avoiding similar failures. NBS also provides methods of materials selection, performance measurement and design criteria that can be incorporated into building codes, bridge and highway standards and other voluntary or legal standards.

- **Corrosion Prevention.** An estimated \$15 billion a year in materials losses occur because of corrosion. NBS experts in metallurgy and related disciplines have more than half a century experience in corrosion research and provide a central resource of expertise to researchers around the world.

- **Standard Reference Materials (SRM's).** Since 1906, NBS has provided SRM's whose chemical composition and properties have been accurately determined and certified. SRM's help industry improve product quality control used in materials, fuels and fertilizers, thereby reducing the number of faulty or rejected products, improving product quality and conserving raw materials.

- **Performance criteria and standards for building materials.** The \$100 billion building industry spends \$40 billion a year on materials. In some cases designers are inefficient in the use of building materials and use excessive quantities. For 50 years, NBS has been the leading U.S. laboratory engaged in developing technical background for standards and test methods for building materials. More recently, NBS has become a national center for building technology through the establishment of the Center for Building Technology (CBT). One goal of CBT is to provide the building community with the information on performance criteria and test methods needed to improve materials use and conservation.

HIGHLIGHTS

Appliance Labeling

As the first step in a broad voluntary energy conservation program for home appliances, Secretary of Commerce Dent recently announced the final specification for labeling room air conditioners to show their energy efficiency. The labels will enable consumers to purchase units that will use energy most efficiently.

The energy labels for room air conditioners make use of a concept known as Energy Efficiency Ratio (EER). The higher the EER number, the more efficient the unit is. The label on appliances of participating manufacturers will show the range of EER's for all room air conditioners of similar size.

Air Conditioner Pamphlet

A new free pamphlet that tells consumers how to choose a room air conditioner on the basis of cooling capacity and energy efficiency has been issued by NBS.

The pamphlet describes what consumers need to know before buying a window or through-the-wall air conditioner. It answers questions on household wiring, cooling requirements of individual rooms, cost of electricity and the relationship of electricity cost to purchase price.

Single copies of "Energy Efficiency in Room Air Conditioners" are available at no charge from the Consumer Production Center, Pueblo, Colo. 81002.

Lead Paint Poisoning

At recent Congressional hearings, NBS Director Dr. Richard W. Roberts gave testimony in support of the Department of Housing and Urban Development's program on lead paint poisoning.

Robert's testimony described the Bureau's work in this area, which is supported by HUD. There are three aspects to the NBS efforts: estimation of the size of the problem, evaluation of methods for detecting lead in paint and identification and evaluation of techniques for eliminating the lead paint hazard in housing.

Networking Terminology

A report on computer networking terminology for business and scientific data processors has been published by the Bureau. It is primarily aimed at easing the communications difficulties arising from the merger of two distinct technological communities: data processing and telecommunications.

Titled "A Guide to Networking Terminology," the report is available as Technical Note 803 from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for 80 cents. Order as SD Catalog No. C13.46:803.

Cooperative MHD Program

NBS is assisting the Office of Coal Research of the U.S. Department of Interior in implementing a cooperative program with the USSR in the field of magnetohydrodynamics (MHD) conversion. Under this program, Russian MHD facilities will be used to study American designed MHD channels and to test advanced materials.

The materials program calls for the design and construction by the American side of an electrode-insulator module which will be placed in one of the Russian MHD facilities. The module, to be constructed of advanced materials, will be tested for 100 hours under full MHD conditions

with both American and Soviet scientists performing the experiments.

Antenna Scanner Completed

Completion of the largest mechanical near-field scanner of its type in the world enables NBS to determine far-field antenna pattern, gain and polarization on much larger antennas than before. The scanner and associated rf measuring equipment are completely automated and can be used to evaluate phase arrays, horn-type antennas and radio-meter antennas.

The NBS-developed technique and equipment allow laboratory measurements of many antennas that otherwise would require huge outdoor ranges, if measurements could be made at all.

Colorado Receives Standards

The State of Colorado recently received a 95-piece set of weights, measures and weighing instruments under the NBS program to provide new weights and measures standards to the 50 states. At a ceremony held in Denver, NBS Director Richard W. Roberts presented the set to John D. Vanderhoof, governor of Colorado.

Housing Column Connections

Column connections used in precast concrete modular housing systems are evaluated in NBS Technical Note 811. The publication gives results of structural performance tests made on column connections used in a housing system employing stacked, precast concrete box modules.

The tests included determinations of: the effect of various bearing pads on the load capacity of the connection, the load-deformation characteristics of the neoprene pads and the strength and ductility of the connections when subjected to a shear force.

This Technical Note may be ordered as SD Catalog No. C13.46:811 from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for \$1.00. □

NBS Urges Charcoal Grill Safety

SOME 90 percent of all accidents involving charcoal grills are due to the improper use of gasoline or other highly volatile liquids, according to studies made by the National Bureau of Standards.

Dr. John W. Lyons, director of the NBS Fire Programs, said numerous burn injuries and several deaths occur each summer when people pour volatile liquids, such as gasoline, over charcoal.

"In a typical case," Lyons said, "a person preparing to relight 'extinguished' charcoal or trying to 'speed up' the fire, pours gasoline from an open can onto the hot coals."

"The gasoline vapors ignite and the flame races up the vapor trail to the can. The startled victim often jerks back or drops the can, splashing the flaming gasoline on his clothing."

Lyons added that there are many dangerous liquids found in the homes that behave in this way. Turpentine and other paint thinners, alcohols and sometimes even kerosene, among

others, may be as hazardous as gasoline. Certain solvents for use with plastics, adhesives and the like are equally dangerous. Labels should be read and obeyed carefully.

Allan K. Vickers of the Fire Programs has made a detailed study of these accidents. Vickers said that some 3 percent of all clothing fires reported to the NBS data system involve charcoal grills. The problem is most serious among adult males, where 6 percent of all clothing fires are traceable to charcoal grill accidents.

"These are high statistics," Vickers said, "when you remember that in most areas of the country, charcoal grills are used only 4 or 5 months out of the year and represent only one of a great many potentially dangerous fire situations."

In order to reduce the extensive personal injury and property damage caused by charcoal fires, NBS recommends that outdoor chefs follow these four simple precautions:

1. Use regular charcoal lighter, not gasoline, to light a fire. And apply the fluid **BEFORE** lighting.
2. Be extra wary of a fire that has "gone out." Frequently charcoals which don't appear to be lit are still hot enough to ignite the vapors of liquids—including charcoal grill lighter—poured on them.
3. If a fire should occur and clothing be ignited, drop to the ground as quickly as possible and roll over to extinguish the flames. Never run—that provides the necessary oxygen to feed the flames.
4. No matter how careful you are, keep a hooked up garden hose handy, to use just in case an accident happens.

"If all of us followed these basic precautions," Vickers said, "we could practically eliminate the pain, financial hardship and loss of life that is all too often the tragic companion of what is intended to be a simple backyard barbecue." □

Bus Experiment Aids Commuter, Energy Conservation, Environment

A National Bureau of Standards report, prepared for the Department of Transportation, Urban Mass Transportation Administration, finds continued success for a federally sponsored experimental express-bus service shuttling commuters into Washington, D.C., from suburban northern Virginia.

Although Federal support for the project is scheduled to end in December 1974, the express bus service will

turn page



continue indefinitely under the local sponsorship of the Northern Virginia Transportation Commission. The report comes as many American cities are seeking to increase public transit usage because of the energy shortage.

Prepared by James T. McQueen, Richard F. Yates and Gerald K. Miller of NBS' Technical Analysis Division, the report found the bus share of daily traffic flow increased from 27 to 40 percent since an express bus-only lane was installed on Shirley Highway in 1969.

Shirley Highway is the major arterial route from northern Virginia into Washington. Most commuters using the highway work either in Washington, the Pentagon or the Crystal City office complex. The latter two are in northern Virginia.

NBS researchers found that approximately 5,000 automobiles have been removed from the daily rush hour since the beginning of the experiment in 1969. This decrease has resulted in reduced auto pollutant emissions (carbon monoxide emissions dropped by 1,755 metric tons, for example) and a saving of approximately 2 million gallons (7.6 million liters) of gasoline over the 4-year period.

The report covers specifically the 1-year period from July 1972 to June 1973. During that year, the analysts found, the streamlined bus service attracted 2,800 additional daily riders. This brought daily ridership to 20,000—compared with only 12,500 before the express bus lane was opened in 1969.

"The busway continues to contribute to the reduction of bus travel time and the improvement of bus schedule reliability by providing a high-speed, congestion-free line haul route," the researchers reported. Unfortunately the impact of the improved bus service in downtown Washington was difficult to measure because of interference from construction of the area's subway system.

Commuters who switched from autos to buses reported that service and comfort features were the primary reasons for their move to public transportation. These included reliability of the service and the convenient arrival and departure schedules. Adequate air conditioning and heating were the most important comfort features.

The project also reported some financial successes. Although rush hour service had always been profitable,

for the first time, during the last half of 1972, the project reported a net surplus in operating revenue for combined rush hour and non-rush hour operations.

Copies of the report (Interim Report 4) may be obtained by writing the Urban Mass Transportation Administration, U.S. Department of Transportation, Washington, D.C. 20591, or the National Technical Information Service, Springfield, Va. 22151. Ask for Com-74-10785. The price is \$4.00 per copy. □

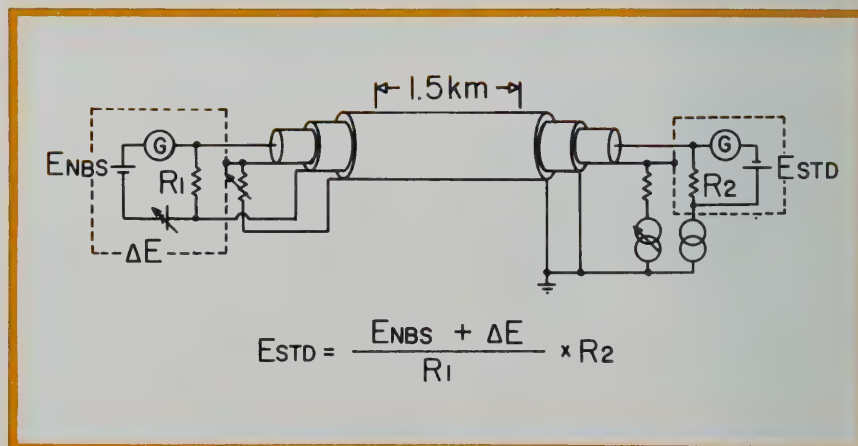
New Voltage Transfer Technique

IN a precedent-setting experiment that utilizes a new method of communicating low-voltage signals through shielded cable, NBS scientists Bruce Field, Paul Olsen and Edwin Williams are now sending the U.S. legal volt signal over a distance of 1.5 kilometers with an accuracy of 3 parts in 10⁸. This allows instantaneous

comparison of precision experiments being carried out at two facilities.

This technique would permit industrial firms and instrument manufacturers to "multiplex" precision voltage signals to calibration stations in noisy or variable-temperature environments, where the use of standard cells would not be possible. The

The voltage of cell labeled ENBS is transferred to the cell ESTD by current transfers.



technique can also be used as a "buffer" to communicate a precision voltage without any risk of damage to the standard cells used for the reference.

The present system is used to transfer the volt between the NBS metrology building, where the NBS volt is maintained, and the non-magnetic building. This voltage is in turn used to establish a known current in a precision solenoid. The field of the solenoid can then be calculated in terms of the NBS unit of current. This system is an essential part of experiments designed to measure the proton gyromagnetic ratio, the absolute ampere and the fine structure constant more accurately than had been possible previously.

The voltage is transferred by sending a constant current through two 100- Ω resistors located at either end

of the cable. The 1-volt drop across each resistor is simultaneously compared with two sets of standard cells. This simple procedure can be completed with a precision of about 2 in 10^8 in only a few minutes.

To prevent leakage of current in the long transfer cable, a dynamic guarded system is used. The transfer current is sent down the center conductor. The first coaxial shield has a guard current in it so that the potential difference between the guard and the center conductor is less than 0.01 volts along the entire length of the cable. This reduces the leakage to less than 2 parts in 10^{10} of the total current. Both currents are returned on a second coaxial shield. A third coaxial shield is grounded to help reduce the pick-up problems.

The primary advantage of this tech-

nique is that errors due to thermal electromagnetic forces in the long cable are completely eliminated. In addition, the sensitive standard cells are protected from capacitive loading by the cable and from the noise picked up in the long cable. In this set up, the accuracy of the transfer is limited to the accuracy with which the ratio of the two 100- Ω resistors is maintained.

This transport technique could readily be adapted to a dissemination system to provide a network of substations. Each substation would have continuous calibration via current transfer back to the master reference. Such a system would be useful in standards laboratories or in industrial applications where precise standards are required in a production-line environment. \square

Stray Energy Monitored

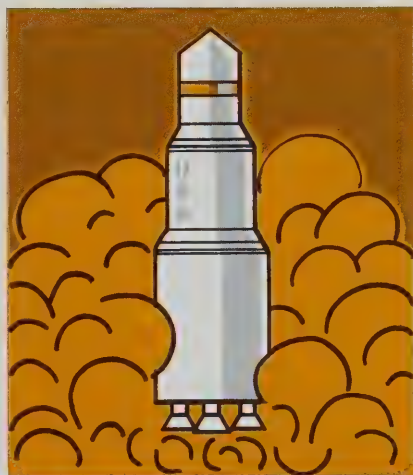
ELECTROEXPLOSIVE devices (EED's) are widely used in military aircraft and space vehicle systems to perform mechanical functions such as bomb releases, rocket engine ignition, tip-tank release and pilot ejection. These devices are small and reliable and can be initiated easily by switch closure.

Unfortunately, EED's are subject to accidental initiation due to pick-up of electromagnetic energy generated either within the system or external to it. To qualify systems for EED safety, it is required that means be provided for checking the electromagnetic energy pick-up in new or modified systems as well as routine testing on the flight-line and in-flight tests.

NBS' Electromagnetics Division has developed two types of stray energy monitor (SEM) devices which are designed to be plugged into EED firing circuits. One of the new SEM's is a go, no-go type and employs a metallic thin film fuse which burns out when power input exceeds 0.03 watts. This sensitivity provides a 30 to 1 (15 dB) safety factor for typical EED's that fire above 1 watt. Two other fuses are connected from each input lead to the device case and burn out when the lead-to-case potential exceeds 10 volts. After exposure, the SEM is connected to a small, battery-powered test box which indicates burn-out of any fuse by means of pilot lights. The Air Force has purchased several thousand of these fuse-type SEM's from commercial sources in competitive bids.

The second SEM employs semiconductor diode detectors and yields quantitative information on the amount of stray energy present in the EED firing circuit. It is designed for testing of new or modified systems.

Both of the new SEM's provide



greater sensitivity than former devices and in addition they allow, for the first time, monitoring of possible hazardous pins-to-case voltages. It is likely that the use of electroexplosive devices will be expanded to systems other than military and space. For example, the automobile airbag system employs such a device. Thus, it is possible that system testing for EED safety will be needed in the private sector in the future. \square

New Computer Standards Proposed

NBS is coordinating two proposed standards and a proposed revision of the Federal COBOL standard with Federal departments and agencies, state and local governments, industry and the public. The two new proposed standards are on code extension techniques in 7 or 8 bits and graphic representation of the control characters in ASCII.

Revision of COBOL

The proposed COBOL revision, which is the adoption of a voluntary industry standard developed by the American National Standards Institute (ANSI), defines the elements of the COBOL programming language and the rules for their use. The standard is used by implementors as the reference authority in developing compilers and by users for writing programs in COBOL.

The primary purpose of the standard is to promote a high degree of interchangeability of programs for use on a wide variety of information processing systems.

Code Extension in 7 or 8 Bits

This proposal adopts a voluntary industry standard developed by ANSI and provides for extensions through use of the ASCII (American Standard Code for Information Interchange) coding structure.

Additional control codes and graphic character codes may be defined. Once defined, these additional codes can then be used in a 7 or 8 bit environment. It is expected that

as a result of this standard additional sets of character codes will be defined for extended Roman characters, mathematical symbols, Greek characters, Cyrillic characters and control characters needed for visual displays and automatic typesetting.

NBS as proposed will serve as the registry for additional code assignments and will publish these as a basic reference.

Graphic Representation of Control Characters

The third proposed standard specifies graphical representation for the 34 control characters of ASCII (FIPS 1) and adopts a voluntary industry standard developed by ANSI.

Interested parties may obtain a copy of the proposed standards from the Office of ADP Standards Management, Institute for Computer Sciences and Technology, NBS, Washington, D.C. 20234.

The comment period for the proposed COBOL revision closes August 2, 1974. The end of the comment period for the proposed standard on code extension techniques in 7 or 8 bits is August 6, 1974, and August 7, 1974, closes the comment period on the standard proposed for graphic representation of the control characters of ASCII. After the comments are received, final determinations and endorsements will be made to the Secretary of Commerce as mandatory Federal Information Processing Standards (FIPS) under the provisions of Public Law 89-306 and Executive Order 11717.

JILA Fellows Named

THE Joint Institute for Laboratory Astrophysics (JILA) of the University of Colorado and the National Bureau of Standards have announced the awarding of 1974-1975 Visiting Fellowships to outstanding scientists from four U.S. Universities and six foreign countries. The Fellowships were awarded on the basis of scholarly achievement and promise, on the demonstrated interest in the scientific and technical objectives of JILA and on recommendations of the recipient's colleagues.

The recipients are Joseph S. Bakos, Central Research Institute for Physics, Budapest, Hungary; James N. Bardsley, University of Pittsburgh; Yu N. Demkov, Leningrad State University; Franz D. Kahn and Frank H. Read, The University, Manchester, England; Joachim Kessler, Westfälische Wilhelms-Universität, W. Germany; James R. Peterson, Stanford Research Institute; John B. Rogerson, Princeton University Observatory; Blair D. Savage, University of Wisconsin; Nicholas I. Shakura, Sternberg State Astrophysical Institute, Moscow; Kiyoji Uehara, University of Tokyo; and Jean-Paul Zahn, Observatoire de Nice, France.

Since 1962 approximately 120 scientists from 20 countries have been awarded Visiting Fellowships. The fields of specialization of the 1974-1975 Visiting Fellows include precision laser spectroscopy, atomic collision theory, atmospheric physics, non-linear optical physics, fluid dynamics and radiative transfer, satellite-based optical astronomy and modeling of black holes.

Jerry-Can Standard Approved

A voluntary standard establishing nationally recognized performance requirements for plastic "jerry-can" containers used to carry and temporarily store gasoline and other petroleum products has been approved for publication by NBS.

The standard was developed by producers, distributors and users of the containers at the request of The Society of the Plastic Industry, Inc. It was processed according to the Voluntary Product Standards procedures of the Department of Commerce.

The standard should be of particular interest to consumers and safety advocates who note a marked increase in storage of gasoline due to soaring prices and short supplies brought on by the energy crisis.

The new standard announced by NBS is intended to decrease the danger of fire or explosion due to improper storage. It will provide producers, distributors, users and fire code officials with a common basis for understanding the characteristics of the product.

Also included in the standard are requirements and tests for softening point, brittleness temperature, aging, stability, strength, permeability and petroleum resistance.

Copies of the Voluntary Product Standard designated PS 6174, "Plastic Containers (Jerry-Cans) for Petroleum Products," will be available from the U.S. Government Printing Office, Washington, D.C. 20402, in 2 to 3 months. For further information call: 301/921-2356.

Two Standards Under Review

TWO recommended Voluntary Product Standards are now being circulated to producers, distributors and users of the products—plastic-coated fabric wallcovering and construction and industrial plywood—to determine their acceptability.

The standard for plastic-coated fabric wallcovering is being developed at the request of the Chemical Fabrics and Film Association. Technological advances in the plywood industry have necessitated a revision of PS 1-66, "Softwood Plywood, Construction and Industrial." Both standards are being promulgated in accordance with the Volun-

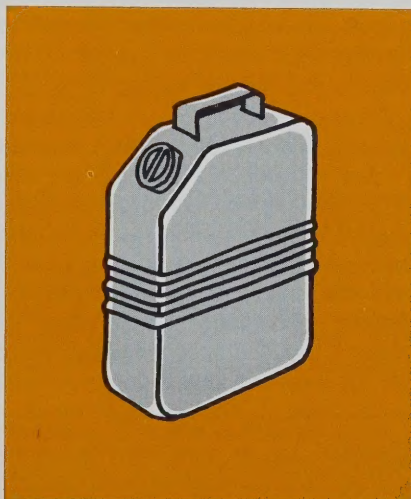
tary Product Standards procedures of the Department of Commerce.

The purpose of the standard for plastic-coated fabric wallcovering is to establish on a voluntary basis nationally recognized quality requirements, thus providing producers, distributors and users with a basis for common understanding of the characteristics of this product. The standard defines three types and two classes of plastic-coated fabric wallcovering based on coating weight and flammability. Other requirements include tear strength, abrasion resistance, shrinkage, stain resistance and colorfastness.

The standard for construction and industrial plywood covers the wood species, veneer grading, panel construction, dimensions and tolerances, marking and packing. It includes test methods to determine compliance and a glossary of trade terms and definitions. An appendix in the standard contains information on generally available sizes, methods of ordering and reinspection practices.

Nationally recognized requirements for the principal types and grades of construction and industrial plywood will be established on a voluntary basis with this standard.

Copies of both recommended Voluntary Product Standards are available without charge from the Office of Engineering Standards Services, NBS, Washington, D.C. 20234. The standard for construction and industrial plywood is designated TS 217b. TS 198a is the standard for plastic-coated fabric wallcovering.



be to eliminate inconsistencies and to identify superfluous or wasteful measurement requirements that can be dropped from the regulations.

Hearing Aids

The primary instrument for measuring loss and tracking its progress is the audiometer. In 1972, something like two million Americans were tested with it, and the number is expected to rise much higher, perhaps into the tens of millions, because of the Occupational Safety and Health Administration regulations. The NBS Sound Section is now investigating the accuracy and reproducibility of audiometer measurements when assembled from various components and used under a variety of conditions. This study will be of particular benefit in factories and schools where, due to cost constraints, audiometric testing must be carried out under less than ideal conditions.

Impaired hearing can very often be improved by a properly fitted hearing aid. Millions of people in the United States use them, and most of these are veterans with service-connected hearing disabilities. The largest single purchaser of hearing aids in the United States is, in fact, the Veterans Administration (VA) which issues the aids to veterans. Under VA sponsorship, the Sound Section makes systematic tests on hearing (1) to determine the nature and extent of different kinds of distortion which a hearing aid (intentionally or otherwise) produces and develop tests to determine the effects of these distortions on the perception of speech, (2) to relate the effects of distortion on hearing to theories of the hearing process, (3) to test about 300 hearing aids each year making use, when appropriate, of new knowledge gained about distortion characteristics and (4) to set up experimental and theoretical procedures for evaluating the effectiveness of hearing aids in compensating for particular kinds of hearing loss

in quiet and noisy surroundings.

The NBS testing program also assists the VA in purchasing, intelligently and economically, the hearing aids that it later issues. In addition to the NBS test results, which are available to the public, two guides on hearing-aids have been published.¹

Hearing Protectors

Hearing protectors—specially designed ear muffs or ear plugs—are an obvious way to protect those who must work in unusually noisy environments. They are widely used, and specifications for testing them are available. Many law enforcement agencies, for example, require their personnel to wear hearing protectors on the firing range. However, none of the existing standards for hearing protectors adequately takes into account their effectiveness against the impulsive noise characteristic of gunfire. Accordingly, the Justice Department initiated a project at NBS to make the necessary study. Measurements were made that verified, first of all, that sound levels on the firing range did present a risk of damage to hearing. Measurements were then made of the attenuation (weakening) of the gunfire noise produced by various hearing protectors. These data made it possible to formulate and issue a voluntary standard on hearing protectors which will be helpful to enforcement agencies buying or replacing this type of equipment.

The projects sketched briefly above, suggest that we are far from helpless in the struggle for a noise-free environment. But as with other environmental hazards, further studies will be needed to better characterize quality and quantity of community noise exposure, particularly as it relates to hearing loss and other effects of noise on the exposed population. □

¹ "Hearing Aids" by Edith L. R. Corliss, NBS Monograph 117, 35 cents; and "Facts about Hearing and Hearing Aids" by Edith Corliss, NBS Consumer Information Series 4, 60 cents. These are available, at the prices indicated, from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

New Research

By 1950, new areas of research such as nuclear physics, numerical analysis, statistical engineering, electronics, radio propagation and thermodynamics were being vigorously explored. Basic work in leather, paper, plastic, rubber and other organic materials had become centered in the new science of high polymers. The top echelons were largely filled with new faces. And the average age level of the staff had dropped by 20 years.

The years of Condon's directorship are noted for numerous outstanding accomplishments, e.g., construction of first atomic clock, first direct (high-field) measurement of the absolute value of the gyromagnetic moment of the proton, first direct measurement of the magnetic moment of the proton in terms of the nuclear magneton, first high-precision physical determination of the faraday, construction of the first high-voltage electron microscope, discovery of the isotope effect in superconductivity, creation of the basic modern numerical analysis needed for the design and exploitation of automatic high-speed digital computers, construction of the first general-purpose internally sequenced electronic digital computer in operation in the United States, first com-

Dr. Condon as NBS Director in 1945.



plete restatement (Public Law 81-619) of the Bureau's functions since its founding and establishment of major new facilities at Boulder, Colo.

Resignation

Condon resigned in September 1951. In his 6 years as Director under three Secretaries of Commerce, he had propelled the Bureau far towards his goal. The "shots in the arm" and "kicks in the seat of the pants" that Condon administered as Director imparted vigor and vitality to the Bureau that were still recognizable many years later.

Condon left the Bureau to become Director of Research at the Corning

Glass Works, where he developed the heat-resistant nose cone that became a part of the Mercury capsule that took Colonel Glenn on his history-making orbit. In 1956, he accepted an appointment as professor of physics at Washington University in St. Louis. He continued as a major consultant to Corning for the remainder of his life. In 1963, he accepted an appointment as professor of physics at the University of Colorado, in Boulder, and as a fellow of the Joint Institute for Laboratory Astrophysics (JILA) of the National Bureau of Standards and the University of Colorado.

At the time of his retirement from the University of Colorado, Condon

was credited with publishing more than 100 scientific papers and with authorship of an equal number of papers and addresses dealing with public issues. His last public appearance was at the NBS Boulder Laboratories on February 22, 1974, for the celebration of the 25th anniversary of atomic timekeeping. □

Readers who wish to learn more about Edward Condon are referred to:

Brittain, W. E., and Odabasi, H., ed., *Topics in Modern Physics: A Tribute to Edward U. Condon*, Colorado Associated University Press (Boulder, Colo.), 1971.

Condon, E. U., *Reminiscences of a Life in and out of Quantum Mechanics*, *International Journal of Quantum Chemistry* (Symposium No. 7), pp. 7-22, 1973.

Curtus, O., *Boulder's Peppery Physicist*, *The Denver Post* (Sunday Empire Magazine Apr. 8, 1973, Section).

PUBLICATIONS

of the National Bureau of Standards

Building Technology

Pielert, J. H., Reichard, T. W., and Masters, L. W., *Structural Evaluation of Steel Faced Sandwich Panels*, Nat. Bur. Stand. (U.S.), Bldg. Sci. Ser. 51, 43 pages (Apr. 1974) SD Catalog No. C13.29/2:51, 90 cents.

Wolfe, W. C., *A Review of Federal and Military Specifications for Floor Coverings*, Nat. Bur. Stand. (U.S.), Tech. Note 822, 99 pages (Apr. 1974) SD Catalog No. C13.46:822, \$1.50.

Wyly, R. S., Sherlin, G.C., and Beausoliel, R. W., *Laboratory Studies of the Hydraulic Performance of One-Story and Split-Level Residential Plumbing Systems With Reduced-Size Vents*, Nat. Bur. Stand. (U.S.), Bldg. Sci. Ser. 49, 53 pages (Mar. 1974) SD Catalog No. C13.29/2:49, 95 cents.

Computer Science and Technology

Cotton, I. W., *Cost-Benefit Analysis of Computer Graphics Systems*, Nat. Bur. Stand. (U.S.), Tech. Note 826, 47 pages (Apr. 1974) SD Catalog No. C13.46:826, 90 cents.

Engineering and Information Processing Standards

Chumas, S. J., Ed., *Index of International Standards*, Nat. Bur. Stand. (U.S.), Spec. Publ. 390, 222 pages (Mar. 1974) SD Catalog No. C13.10:390, \$5.60.

Johnson, D. P., *Note on Diffusion of Vapor into Flowing Gas*, J. Res. Nat. Bur.

Stand. (U.S.), 78A (Phys. and Chem.), No. 1, 49-51 (Jan.-Feb. 1974).

Measurement Science and Technology

Barnes, J. A., and Winkler, G. M. R., *The Standards of Time and Frequency in the U.S.A.*, Nat. Bur. Stand. (U.S.), Tech. Note 649, 91 pages (Feb. 1974) SD Catalog No. C13.46:649, \$1.00.

Hellwig, H., *Frequency Standards and Clocks: A Tutorial Introduction*, Nat. Bur. Stand. (U.S.), Tech. Note 616 (Revised), 72 pages, (Mar. 1974) SD Catalog No. C13.46:616 (Rev.), 70 cents.

Kelly, K. L., *Colorimetry and Spectrophotometry: A Bibliography of NBS Publications January 1906 through January 1973*, Nat. Bur. Stand. (U.S.), Spec. Publ. 393, 54 pages (Apr. 1974) SD Catalog No. C13.10:393, 95 cents.

McAlister, A. J., Dobbyn, R. C., Cuthill, J. R., and Williams, M. L., *Soft X-ray Emission Spectra of Metallic Solids: Critical Review of Selected Systems and Annotated Spectral Index*, Nat. Bur. Stand. (U.S.), Spec. Publ. 369, 176 pages (Jan. 1974) SD Catalog No. C13.10:369, \$1.85.

Powell, R. L., Hall, W. J., Hyink, C. H., Jr., Sparks, L. L., Burns, G. W., Scroger, M. G., and Plumb, H. H., *Thermocouple Reference Tables Based on the IPTS-68*, Nat. Bur. Stand. (U.S.), Monogr. 125, 410 pages (Mar. 1974) SD Catalog No. C13.44:125, \$4.55.

Steiner, B., *Optical Radiation Measurements: The Present State of Radiometry and Photometry*, Nat. Bur. Stand. (U.S.), Tech. Note 594-6, 56 pages (Mar. 1974) SD Catalog No. C13.46:594-6, 95 cents.

Westley, F., *Vibrationally Excited Hydrogen Halides: A Bibliography on Chemical Kinetics of Chemiexcitation and Energy Transfer Processes (1958 through 1973)*, Nat. Bur. Stand. (U.S.), Spec. Publ. 392, 81 pages (Apr. 1974) SD Catalog No. C13.10:392, \$1.30.

Radio Transmission and Electromagnetic Studies

Kerns, D. M., *Scattering-Matrix Description and Near-Field Measurements of Electroacoustic Transducers*, Nat. Bur. Stand. (U.S.), Tech. Note 651, 40 pages (Mar. 1974) SD Catalog No. C13.46:651, 50 cents.

Publications listed here may be purchased at the listed price from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (foreign: add 25%). Microfiche copies are available from the National Technical Information Service, Springfield, Va. 22151. For more complete periodic listings of all scientific papers and articles produced by NBS staff, write: Editor, Publications Newsletter, Administration Building, National Bureau of Standards, Washington, D.C. 20234.

